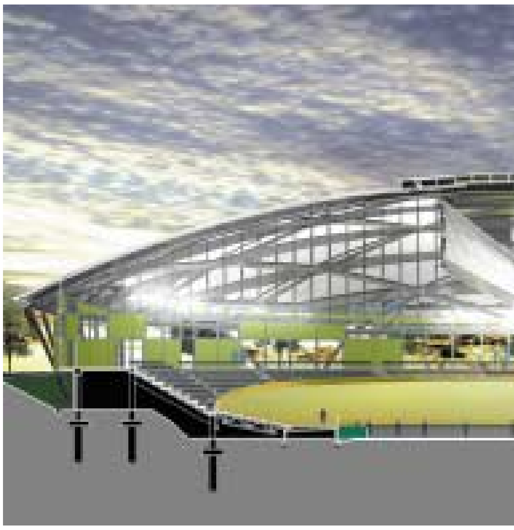
This case study was written at the time when OneSteel was part of BHP. In that context, in some instances within this case study, reference may be made to BHP.

Olympic



According to architect Paul Ryder, the recently completed Olympic Velodrome at Bankstown in Sydney's south-west was always going to feature structural steel.

"Only steel could provide a structural system to support such a large span project," Paul said.

Indeed, the $41M Dunc Gray Velodrome, named after Australia's first Olympic gold medallist for cycling, is the biggest single span structure in Australia.

"Structural steel provided the strength and lightness needed for the project, with fewer construction difficulties than other materials," Paul said.

"I never wanted to hide the steel away. I liked the idea of big members, surrounded by a light secondary structure. I also wanted the building to be dynamic."

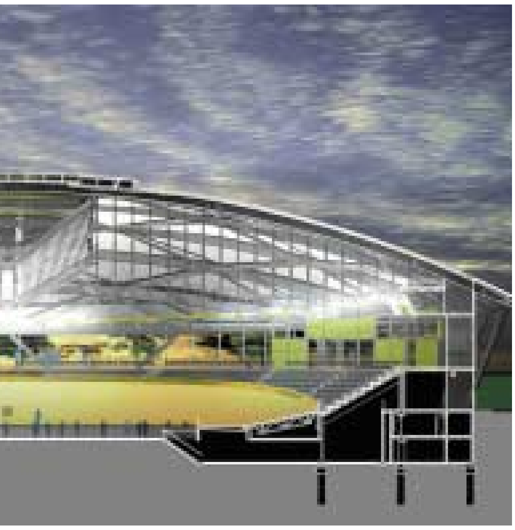
The architect's vision for a dynamic and modern structure is borne out by the curved roof of the velodrome, which is largely a result of the design and engineering collaboration with Peter Bailey from Ove Arup and Partners.

The roof is based on a shell, which is supported by box girder arches, laced together with diagonal tubes. This structure is supported by a ring beam, which is in turn supported by diagonal tubes acting as V-columns.

Although it appears to be rather curved when looking up from inside the velodrome, the roof shell only rises 12 metres and is therefore quite flat for its span, which is 100 metres across and 150 metres long.

Roof under construction.

Velodrome showcases steel



Cross-section showing roofing, seating and track.

As the roof shell and the lower part of the structure move independently of each other, sailcloth is used to connect the shell to the top of the walls to absorb differential movement.

Paul did not want a separate small foyer, rather it should be integrated into the main space. This vision is now a reality. While standing in the foyer one can get a clear view of the entire building.

Paul saw no reason to change the framing of the V-columns in the foyer. As a result, a dramatic effect has been achieved as the ring beam passes through glass walls and is supported by the same bold V-columns as are used around the velodrome's circumference.

These tubes become a sculpture-like focal point for the foyer, as they seem to erupt through an opening in its concrete floor.

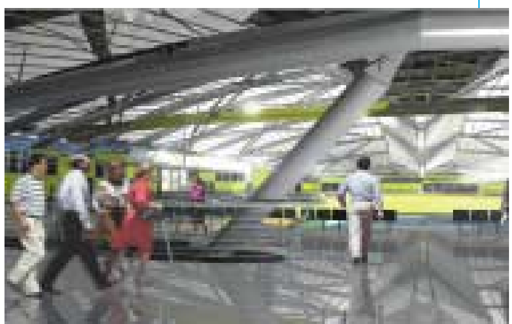
In addition to being an interesting focal point for the foyer, the opening in the floor connects the public area above with the athletes' area on the level below.

Environmental Design for 'Green Games'

The brief from the Olympic Co-ordination Authority sought a concept design for an environmentally sustainable facility. To answer this challenge, the architect devised an

Top: Artist's impression showing roof frame and skylight.

Below: Artist's impression of V-columns in foyer.



environmental strategy that maximises the use of natural light and ventilation.

Sunlight enters the velodrome through a large skylight that runs along the spine of the roof. Louvres diffuse the light and spread it throughout the spectator areas of the building. This system provides shadow-free light on even an overcast day, requiring no artificial light for day sessions.

While there is mechanical ventilation in the lower areas, the spectator zone relies solely upon a heat stack for ventilation. The skylight generates hot air near the roof. As this hot air rises, it draws cool air through vents located under the spectator seats, which exits through vents in the roof.

In addition, sun shades external to the western side of the building shield the velodrome from the hot afternoon sun.

Internal view at track level, during construction.

Specific Purpose, Versatile Design

The velodrome has a seating capacity of 3000, however during the Olympics, temporary seating will be installed, bringing the capacity to 6000.

The ultimate owner of the velodrome will be Bankstown Council, so in addition to incorporating the Olympic mode, the building will be used for other sports and community events.

To this end, the access tunnel is designed to accommodate large vehicles, and emergency egress for 1000 people is provided.

A specific issue for the design of a velodrome is the importance of maintaining sightlines for the spectators. This is complicated by the fact that the slope of the race track changes dramatically around the circuit.

The architect consciously set out to minimise blind spots for spectators by providing steeper seating tiers, increasing the height between seat rows to half a metre. At each end of the velodrome where the track is steepest, the step height has been increased further, to one metre.

“People in the end seating sections tend to stand up so the competitors don’t disappear from view,” Paul said. “By increasing the step height to one metre, it doesn’t matter if someone stands up in front of you. This is particularly important for spectators in wheelchairs.”

The architect’s design also incorporates three rows of seating around the steep bends, where no-one else has attempted more than one.

Not a Helmet After All

Surprisingly enough, the design of the velodrome is not based on a cyclist’s helmet, as claimed by many commentators.

The design actually evolved from the local topography.

“The velodrome is the structural equivalent of the topography of the site, which features low, undulating hills,” the architect said.

The curved roof of the velodrome complements the natural landforms surrounding the building, and is a natural complement to the greenfield site. The roof is extended at the front of the building, simply to cover the entrance foyer.

In keeping with the topographical theme, the western side of the velodrome seems buried in the adjacent hill, while on the eastern side, the building is exposed.

Client:	Olympic Co-ordination Authority
Architect:	Ryder SJPH Architects
Engineer:	Ove Arup & Partners
Builder:	Walter Constructions
Project Manager:	Australia Pacific Projects
Fabricator:	National Engineering
Shop Detailer:	S & J Drafting
Artist’s Impressions:	Ryder Associates
Photographs, Page 10:	Ryder Associates

Above: Roof-line matching local typography.